

**TRIDENT II MISSILES:
CAPABILITY, COSTS, AND ALTERNATIVES**

**The Congress of the United States
Congressional Budget Office**

**For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, DC 20402**

NOTES

All years in this report are fiscal years, unless otherwise stated.

Unless otherwise indicated, all budget figures are in fiscal year 1987 dollars.

Figures in the text and tables of this report may not add to totals because of rounding.

Budget figures do not include the cost of procuring ballistic missile warheads. These costs, which are paid by the Department of Energy, are classified.

PREFACE

The Administration is currently modernizing all three legs of the U.S. strategic nuclear triad: bombers, land-based missiles, and submarine-based missiles. As part of this effort, the Administration has asked the Congress to approve initial procurement in fiscal year 1987 of the Trident II missile, which would be deployed aboard Trident submarines.

The Trident II missile, which would be larger, more powerful, and nearly twice as accurate as the Trident I missile that it would replace, would greatly increase U.S. ability to destroy hardened targets in the Soviet Union. This planned increase in U.S. capability has raised concerns about the effect that acquiring the Trident II will have on the ability of the United States to keep a crisis from escalating to nuclear war. Moreover, the costs to achieve this capability are high. This analysis by the Congressional Budget Office (CBO) addresses the costs and capabilities associated with the Administration's program and compares that program with three alternatives. This study was requested by the House Committee on the Budget. In accordance with CBO's mandate to provide objective analysis, the report makes no recommendations.

Jeffrey A. Merkley of CBO's National Security Division prepared the study, under the general supervision of Robert F. Hale and John D. Mayer, Jr. The author thanks Theodore A. Postol of the Center for International Security and Arms Control, Stanford University, for his comments on an earlier draft. (External reviewers bear no responsibility for the final product, which rests solely with CBO.) The author also gratefully acknowledges the contribution of William P. Myers, who assisted with the cost analysis; the contributions of Bonita Dombey, Brad Cohen, and Bertram Braun of CBO's National Security Division; and the assistance of Dorothy Amey, also of CBO. Sherry Snyder, assisted by Nancy H. Brooks, edited the manuscript, and Rebecca J. Kees prepared it for publication.

Rudolph G. Penner
Director

July 1986

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SUMMARY

The United States has deployed three types of strategic nuclear weapons: bombers, land-based missiles, and submarine-based missiles. This triad is designed to deter the Soviet Union from initiating a nuclear war and, if deterrence fails, to enable the United States to employ nuclear weapons in a manner chosen by the U.S. national command authority. All three types of weapons are being modernized. One hundred B-1B bombers are being delivered; air-launched cruise missiles are being deployed on existing B-52 bombers; and development of a new advanced technology or "stealth" bomber continues. Also, the deployment of 50 MX intercontinental ballistic missiles (ICBMs) has been approved. Trident submarines, seven of which have already been deployed and one of which is on sea trials, will continue to replace the older Poseidon submarines.

In addition to these plans, the United States intends to deploy a new submarine-launched ballistic missile (SLBM), the Trident II. The Administration has requested the Congress to fund the first procurement of this missile this year. Its ongoing development and planned procurement is expensive, totaling more than \$26 billion between fiscal year 1987 and the year 2000.

The Trident II would eventually replace the Trident I missile on the first eight Trident submarines and would be deployed as original equipment on the subsequent Trident submarines. The greater payload and improved accuracy of the Trident II would enable it to carry larger warheads and deliver them more precisely, making the Trident II very effective in attacking targets, such as Soviet ICBM silos, that have been hardened against nuclear blasts. By the year 2000, approximately 4,800 hard-target warheads would be deployed on Trident II missiles on 20 Trident submarines, resulting in more than a fourfold increase in the number of U.S. hard-target warheads deployed on ballistic missiles.

This planned increase in U.S. hard-target capability would transform the ability of the United States to conduct large-scale attacks on hardened targets in the Soviet Union. The Administration maintains that this change would enhance U.S. deterrence of a Soviet strike. Others counter that the change would have the opposite effect, increasing the probability that a crisis would escalate to nuclear war.

ARGUMENTS FOR AND AGAINST HARD-TARGET CAPABILITY

The ability of U.S. strategic nuclear weapons to survive a Soviet attack and be able to retaliate is the foundation of the U.S. strategy for deterring a nuclear war. Consequently, submarine-launched ballistic missiles are a particularly important part of the U.S. triad of strategic weapons because submarines are less vulnerable to an attack by the Soviet Union than either bombers or missiles based in silos. In addition to being based on submarines, however, the Trident II missile would also have a short flight time to the Soviet Union and the ability to attack and destroy hardened Soviet facilities. These additional features have raised the issue of whether deployment of the Trident II would strengthen or weaken U.S. ability to keep a crisis from escalating to nuclear war.

Proponents of deploying the Trident II and, more generally, expanding U.S. hard-target capability argue that the Trident II would increase U.S. ability to deter a nuclear war. They argue that to deter the Soviet Union from launching a limited nuclear strike against selected U.S. military targets such as missile silos or command centers, the United States must be able to retaliate promptly against diverse sets of Soviet targets that are hardened against nuclear attack. The Trident II missile would provide that capability even after a Soviet attack, since submarines at sea are expected to survive. Increased hard-target capability might also help deter a massive Soviet nuclear attack by enabling the United States to retaliate against critical Soviet facilities such as missile silos and command centers.

Opponents of hard-target capability counter that the Soviet Union would not initiate a limited nuclear strike because the military value of such a strike would not justify the risk that the nuclear war, once initiated by the Soviet attack, would escalate to massive nuclear warfare that would destroy the Soviet Union. Also, deterrence of a massive Soviet attack, argue opponents, is achieved by U.S. capability to retaliate and destroy the Soviet Union as a functioning society, a capability that does not depend on having hard-target warheads. Moreover, expanded U.S. hard-target capability might cause Soviet leaders to prepare to launch their ICBMs on warning of a U.S. attack or to take other actions that increase the probability that a crisis would escalate to nuclear war.

This study cannot resolve the merits of these and many other important arguments for and against hard-target capability. The Administration clearly favors acquiring the capability and plans to do so principally by deploying the Trident II missile. This report analyzes the Administration's plan and alternatives to that plan.

THE ADMINISTRATION'S PLAN

The Administration's plan, as noted above, calls for backfitting the first eight Trident submarines with Trident II missiles and deploying Trident II missiles as original equipment on the ninth and subsequent Trident submarines, building toward a force of 20 submarines.

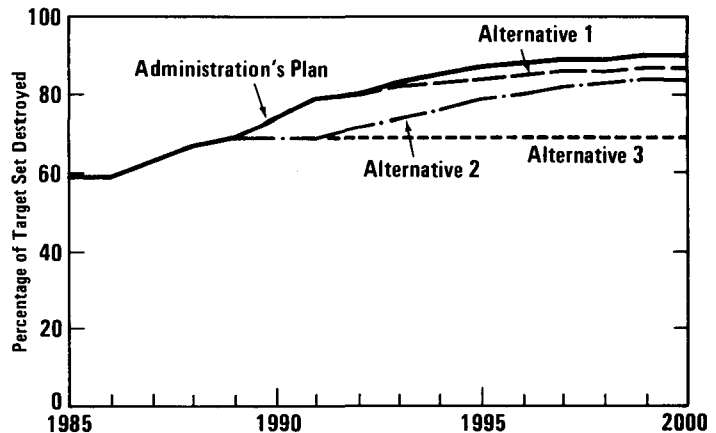
By the year 2000, when 20 Trident submarines would be deployed, the U.S. inventory of all classes of hard-target warheads would have grown from today's level of 1,650 to at least 6,800, including 4,800 warheads on Trident II SLBMs (see Summary Figures 1 through 3). The total number of U.S. ballistic missile warheads would not change much, however, since older systems without hard-target capability would be retired.

This growth in the number of hard-target warheads would greatly increase U.S. ability to destroy both small and large sets of hardened targets in the Soviet Union. The Summary Figures show capability against two hypothetical target sets hardened to 2,000 pounds per square inch (psi)--one large set (2,000 targets) and one small set (500 targets). Assuming that all hard-target warheads on U.S. ballistic missiles--those on submarines as well as land-based missiles--attack the large set, the percentage of targets destroyed would rise under the Administration's plan from 59 percent in 1986 to 90 percent by the year 2000. It may be appropriate, however, to consider only warheads on submarines, since they are thought most likely to survive a Soviet attack. Then the percentage destroyed would rise from about 28 percent in 1986 to over 85 percent by the year 2000. Results are similar if submarine-based warheads attack the small target set, which reflects a more limited U.S. mission or a decision that some targets can be attacked with other weapons such as bombs and air-launched cruise missiles.

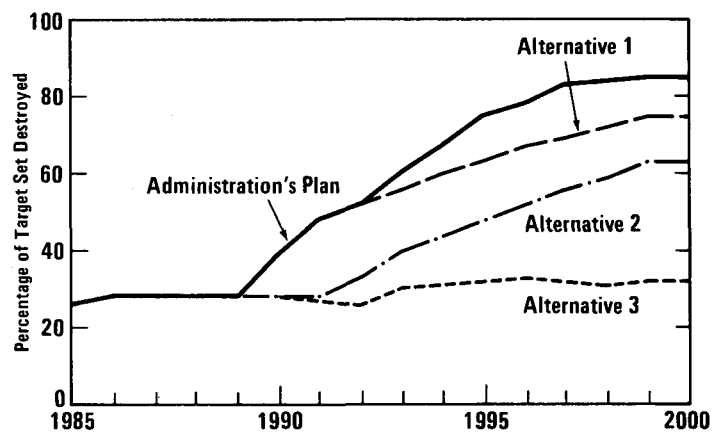
These measures provide a range of estimates of the growth of hard-target capability under the Administration's plan; choice among the range depends on notions of what is needed to deter a nuclear war and, if deterrence fails, to provide U.S. leaders with appropriate retaliatory options.

Costs to achieve this added capability would be substantial. Between now and the year 2000, the United States would spend \$26 billion to complete development and to procure 844 Trident II missiles. About 90 percent of these costs would go toward procurement, since development has largely been completed. In 1987 alone, the Administration would spend \$3.1 billion to continue development of the Trident II and to procure 21 missiles (see Summary Table).

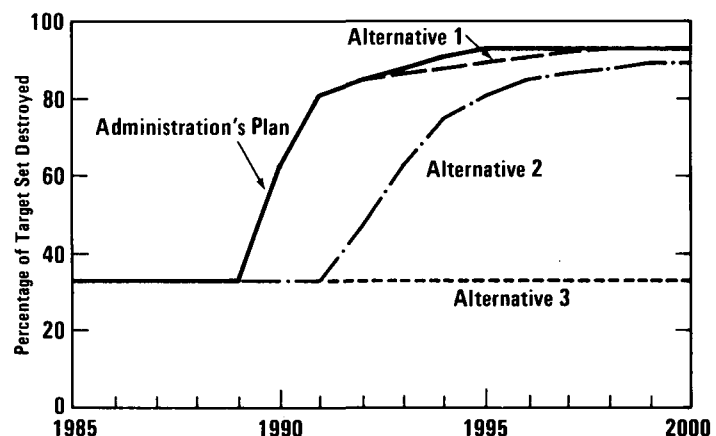
Summary Figure 1.
Administration's Plan
and Alternatives:
Performance of U.S.
ICBMs and SLBMs
Against a Large Target
Set, Fiscal Years
1985-2000



Summary Figure 2.
Administration's Plan
and Alternatives:
Performance of U.S.
SLBMs Against a Large
Target Set, Fiscal
Years 1985-2000



Summary Figure 3.
Administration's Plan
and Alternatives:
Performance of U.S.
SLBMs Against a Small
Target Set, Fiscal
Years 1985-2000



SOURCE: Congressional Budget Office.

NOTE: A large target set (Summary Figure 1 and Summary Figure 2) is 2,000 facilities; a small target set (Summary Figure 3) is 500 facilities. All three figures illustrate the performance of ballistic missiles against target sets hardened to 2,000 psi. The calculations are based on the assumptions that no more than two warheads are allocated against any one target and that the reliability of SLBMs is 80 percent. U.S. warheads are allocated to maximize the percentage of targets destroyed. Alternative 1 = Cancel Backfits; Alternative 2 = Delay Procurement of Trident II Missiles; Alternative 3 = Cancel Trident II Program.

SUMMARY TABLE PROGRAM COSTS FOR THE ADMINISTRATION'S
TRIDENT II PROGRAM AND SAVINGS UNDER
ALTERNATIVE PLANS (Fiscal years; budget
authority in billions of 1987 dollars)

	1987	1987-1991	Total Program (1987-2030)
Costs for the Administration's Plan			
Investment <u>a/</u>	3.1	13.4	26.1
Other <u>b/</u>	<u>4.3</u>	<u>21.7</u>	<u>78.5</u>
Total	7.4	35.1	104.6

Savings from the Administration's Plan

Alt 1: Cancel Backfits	<u>c/</u>	0.5	5.3
Alt 2: Reduce and Delay Trident II	0.4	1.4	2.9
Alt 3: Cancel Trident II	0.4	2.0	9.6

SOURCE: Congressional Budget Office.

NOTE: Budget figures do not include the cost of procuring ballistic missile warheads. These costs, which are paid by the Department of Energy, are classified.

- a. Includes research and development, procurement, and military construction for the Trident II missile.
- b. Includes operating and support costs for the Trident and Poseidon submarines; flight tests for Trident I and Trident II missiles; procurement of Trident submarines; the cost of converting the first eight Trident submarines to carry Trident II missiles (if applicable); and the cost of converting submarines under construction to carry Trident I missiles (if applicable).
- c. Savings in fiscal year 1987 would be \$2.5 million.

Nor are these the only costs associated with the Administration's Trident II program. More submarines would be bought and operated, and the Trident submarines already carrying the Trident I missile would have to be modified to carry the Trident II missiles. Between now and the year 2030--at which time only a few Trident submarines would still be operating--the total cost of the Trident program would amount to about \$105 billion.

ALTERNATIVES TO THE ADMINISTRATION'S PLAN

To hold down costs or to reduce growth in hard-target capability, the Congress could consider alternatives to the Administration's plan. None of the alternatives in this study would greatly alter the total number of U.S. ballistic missile warheads planned by the Administration. But the alternatives would alter the proportion of warheads with hard-target capability and the cost of deploying those warheads. Alternatives include:

- o Cancel plans to backfit the first eight Trident submarines with Trident II missiles.
- o Reduce and delay procurement of the Trident II by canceling the backfit program and deploying the Trident I on four additional Trident submarines.
- o Cancel the entire Trident II program and deploy the Trident I missile on 20 Trident submarines.

Alternative 1: Cancel Backfits

Eliminating the current plan to backfit the eight Trident submarines designed to carry the Trident I missile with Trident II missiles would allow substantial growth in U.S. hard-target capability, though less than would occur under the Administration's plan. This alternative would also achieve long-term savings by making fuller use of the Trident I missiles, some of which would be retired early under the Administration's plan.

Under this alternative, only 12 Trident submarines--the ninth through the twentieth--would be deployed with Trident II missiles. As a result, the number of hard-target warheads on ballistic missiles by the year 2000 would decrease from 6,800 under the Administration's plan to 4,880. This change would have only a small effect, however, on the ability of U.S. SLBMs to

conduct retaliatory strikes. The percentage of a hypothetical target set of 2,000 hardened facilities that could be destroyed by U.S. SLBMs, for example, would decrease from 85 percent under the Administration's plan to 75 percent (see Summary Figure 2).

This option would save money by eliminating the conversion of the first eight Trident ships and reducing procurement of the Trident II by 187 missiles. No new Trident I missiles would be needed, even though the test program for the Trident I would be extended. Savings in the near-term would be small (\$2.5 million in fiscal year 1987 and \$63 million in fiscal year 1988), but \$5.3 billion would be saved over the course of the program.

Alternative 2: Reduce and Delay the Trident II Program

By delaying the Trident II program, this alternative would achieve greater near-term savings and would result in the deployment of fewer hard-target warheads than the previous alternative. Long-term savings, however, would be lower.

In addition to canceling the backfit of the first eight Trident submarines, this alternative would reconfigure the ninth through twelfth submarines--which are already under construction and are designed to accommodate the Trident II missile--to carry Trident I missiles. Therefore, only eight Trident submarines would eventually carry the Trident II missile. Because the Trident II missile would not be required until the thirteenth Trident submarine is deployed, near-term savings could be achieved by postponing procurement of the Trident II until 1990.

By the year 2000, this approach would reduce the number of U.S. hard-target warheads on ballistic missiles by 40 percent and would have a significant effect on U.S. ability to retaliate with SLBMs against a large target set. The ability of U.S. SLBMs to destroy the hypothetical target set of 2,000 targets, for example, would decrease from 85 percent under the Administration's plan to about 63 percent (see Summary Figure 2).

This alternative would also affect deployment schedules and test programs. Reconfiguring the ninth through twelfth submarines could cause each submarine to be delayed by up to two years, although this could be compensated for by extended deployment of Trident I missiles on Poseidon submarines. The Trident I flight-test program--designed to update estimates of missile reliability and accuracy--would be extended to support Trident I deployments. The test program, however, would be reduced to six

flights per year, which is the minimum necessary to meet guidelines set by the Joint Chiefs of Staff.

The savings in this option reflect cost reductions partially offset by increases. On the one hand, modification of the first eight submarines would be canceled and the procurement of Trident II missiles would be delayed by three years and reduced by 328 missiles. On the other hand, sustaining the Trident II research program during the three-year delay in procurement would add to costs and reduce the efficiency of the Trident II program. Modifications to the ninth through twelfth submarines, extended deployment of the Poseidon submarines, and modification of the Trident base at Kings Bay, Georgia, to handle Trident I missiles would also add to costs. Thus, although this option would save more in 1987 than the previous alternative, it would save less in the long term. Net savings would be \$0.4 billion in fiscal year 1987 and \$1.4 billion in fiscal years 1987 through 1991. Savings over the total program would be \$2.9 billion.

Alternative 3: Cancel the Trident II Missile

This alternative, by canceling the Trident II program at the end of fiscal year 1986, would generate larger savings and less hard-target capability than either of the previous alternatives. The Trident I production line would be reopened to provide enough Trident I missiles to fill 20 Trident submarines and to conduct a flight-test program at the level currently planned for the Trident II missile.

Canceling the Trident II program would eliminate deployment of hard-target warheads on U.S. submarines. Thus, the only growth in the U.S. inventory of hard-target warheads on ballistic missiles would be from the deployment of new ICBMs. This alternative therefore would have a significant impact on U.S. ability to retaliate with SLBMs against both large and small target sets. The percentage of the hypothetical set of 2,000 targets that could be destroyed by U.S. SLBMs in the year 2000, for example, would decrease from 85 percent under the Administration's plan to 32 percent (see Summary Figure 2). Unlike the other alternatives, this one would also have a strong impact on U.S. capability to retaliate against the small set of 500 targets. The percentage of that target set that could be destroyed by U.S. SLBMs would decrease from 93 percent under the Administration's plan to 33 percent (see Summary Figure 3).

As in the previous alternative, savings reflect increases and decreases in costs. Savings stem mostly from canceling procurement of 844 Trident II

missiles and from eliminating the modification of the first eight submarines. These savings would be partially offset, however, by the cost of converting the submarines under construction to carry the Trident I missile rather than the Trident II. More important, it would be necessary to reopen the Trident I missile line, which would require requalifying contractors, refurbishing tooling, and redesigning and testing parts for which the original materials or components are no longer available. In addition, the submarine port at Kings Bay would need to be modified. These tasks might cost between \$3.5 billion and \$5.2 billion. Finally, this option would make it impossible for the United States to provide Trident II missiles to the United Kingdom as currently planned. The United Kingdom would therefore have to modify the design of its planned submarines to accommodate the Trident I missile.

If reopening the Trident I line costs \$5.2 billion, this option would produce net savings of \$0.4 billion in fiscal year 1987 and \$2.0 billion over five years (1987-1991). Over the entire program, the savings would be \$9.6 billion. If reopening the Trident I line costs only \$3.5 billion, additional savings of \$1.7 billion could be achieved between fiscal years 1987 and 1990. These savings would have to be weighed against the loss in hard-target capability and the time-consuming and costly efforts needed to resume production of the Trident I missile.